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REPORT ON THE COMPARISONS BETWEEN RENA AND OTHER WRECK REMOVAL OPERATIONS IN RECENT YEARS

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LOC was asked to provide a report considering 10 similar incidents (to the RENA) that have occurred in recent years. In the given time frame it has not been possible to research in depth into 10 "identical" cases and as such we have selected 10 vessels/wrecks that each has some similarity to the RENA case.

It should be stated that each salvage and/or wreck removal operation is unique in the problems and the resulting solutions. There is no fixed method which results in success for each operation. Problems and the resulting solutions are manifested by various external influences, namely; local environmental conditions (weather, sea state), location (remote, accessible), infrastructure and access to the vessel/wreck, intervention by the relevant authorities, availability of suitable equipment and personnel, contractual agreement, to name but a few. What should be considered is that the salvage industry is, by necessity resourceful; solutions can be engineered for virtually any problem. However, this service comes at a price and this price is high. 15 years ago a $10million operation was perceived as high, now operations in excess of $100million are not uncommon.

Some of the comments provided in the case studies are extracted from the International Group of P&I Clubs report; "IG Large Casualty Working Group Review of Casualties Involving Salvage/SCOPIC and Wreck Removal 2002-2012 and refer to the level of intervention undertaken by the relevant regulatory authority in each case.

It should also be noted that in general P&I Clubs will not remove a wreck voluntarily (unless there is a long-term exposure risk to the P&I Club, such as a risk to navigation), there needs to be a legal mechanism in place which is enforceable by the relevant regulatory authority, which places a liability on the owner to remove the wreck in question. In all but one of the case studies, at least partial removal of the wreck was undertaken; the one wreck still in place is presently being challenged in court. Some of the other wrecks considered were in general, removed in their entirety, where this was not the case, small sections were allowed to remain in situ with the agreement of the relevant authorities.

Some of the cases reviewed resulted in high cost wreck removal operations some of which were caused by the lack of clarity at the outset. It is imperative that the owners are made aware from the initial stages what the expectation is of them by the regulatory authority.

The prices referred to in this report are those as calculated by TMC on behalf of the RENA owners and their P&I Club, whilst I believe them to be high, they do reflect the scale and cost of any future operation to remove the wreck in its entirety. It is certain that any operation to remove the RENA in its entirety will be time consuming and as a consequence costly. It can be undertaken, the industry has the ability to do this, the question is whether the insurance industry has the stomach for it.

1. INTRODUCTION

1.1 Instructions Received

1.1.1 We are instructed by Sid Wellik, Manager Legal Services, Maritime New Zealand (MNZ) to comment on the comparisons between the M.V. RENA Wreck Removal operation and other wreck removal operations undertaken in recent years.

1.1.2 In particular we have been asked to specifically consider and provide comments on the following aspects:

1. *Your own background and a few major salvage operations that LOC has been involved in.*

2. *Identify ten marine casualties that are similar to RENA. For clarity, these similarities are:*

   - *Grounded*
   - *Grounded on a reef.*
   - *Preferably a container ship.*
   - *Similar distance offshore.*
   - *The ship/wreck under a similar depth of water.*
   - *Similar weather conditions.*

3. *Please advise what occurred operationally with these casualties. In doing so, please advise how much, or whether all, of the hazardous cargo was removed, and whether the remains of the wreck were fully removed.*

4. *Based on those factual examples, can you extract for us some basic principles of "World best practice" regarding the extent to which different Administrations require removal.*

1.1.3 Further to our initial instructions we were subsequently asked to consider and comment on the following aspects:

i. Where parts of the wreck were left behind and for partial removal, how much was left behind.

ii. Why was this left behind; cost, safety, no longer an environmental risk etc.

iii. Clarify how much, in tonnage, is currently left of RENA (Stern and Forward) and how much is being proposed to be left behind by owners as set out in their RMA consent.

iv. What damage could be done to the reef if the forward section were fully, or almost, removed?

v. Is there any hazardous material left in the forward section, if so, what?

vi. Should any of the containers in the stern section "implode", what are the likely contaminants?

vii. What is the best practice for monitoring, what should we expect to occur and for how long?

I was also subsequently asked to comment on the costs and timescales quoted by TMC in their report for the removal of the three RENA entities (Bow Section, Debris Field and Stern Section) and the reasonableness of those costs and timescales.

1.2 Scope of the Report

1.2.1 To provide expert opinion on "world best practice" in the present era, in respect to wreck removal operations. Considering similar cases to the RENA incident: Grounded on a reef, Container vessels, similar distance offshore, similar water depth and weather conditions.

To enable me to consider this I have called on the experience that LOC has with wreck removals in the last 10 years or so.

2. BACKGROUND

2.1 London Offshore Consultants

2.1.1 London Offshore Consultants (LOC) was established in 1979 to provide independent, high quality marine & engineering consultancy and surveying services to the world's shipping and offshore energy industries. In the late seventies, the four founders made up of two master mariners and two civil engineers saw the need for marine and engineering consultancy and so LOC's first office was opened in London on Fenchurch Street.

Since then, LOC has grown into a global organisation with offices strategically located in the major energy and shipping locations throughout Europe, Africa, Americas, Middle East, Asia and Australia, employing in excess of 350 personnel in 29 different locations. The technical staff consists of Master Mariners, Marine Engineers, Naval Architects, Structural Engineers, Pipeline Engineers, Subsea Engineers, Marine Civil Engineers and Geotechnical Engineers.

LOC provides expert advice on a wide range of marine related issues, including provision of expert evidence, technical support during Court and/or Arbitration proceedings. The five principal revenue streams are Claims, Damage and Litigation (CDL), Marine Casualties (MC) Marine Warranty services (MWS), Marine and Engineering Consultancy (MEC) and Surveys, Inspections and Audits (SIA).

LOC acts on behalf of ship owners, Protection and Indemnity (P&I) Clubs, Hull and Machinery Underwriters (H&M), Cargo Insurers, Charterers, Salvage Companies and provides information and advice to various regulatory authorities around the World.

2.1.2 LOC has developed a reputation for unbiased, independent advice on marine casualties, working principally for P&I and Property Underwriters (H&M and Cargo Underwriters). LOC has ten Special Casualty Representatives (SCR)[1] appointed by the SCR Panel who act as salvage experts in respect to Lloyds Open Form SCOPIC contracts. This expertise has been developed over decades and the majority of SCR appointments are undertaken by LOC's SCRs. In addition, LOC employs two ex-salvage masters and a number of naval architects all of whom have a broad knowledge of salvage methodologies and expertise.

2.1.3 In the case of vessels becoming wrecks, LOC is able to provide technical assistance in undertaking a closed tender process on behalf of P&I Clubs and assessing the bids received on technical merit, functionality and cost basis. LOC is able to assist on site by providing Client Representatives to monitor the operation.

Recent high profile wreck removal cases include:

CORAL BULKER	Bulk Carrier	2001	Portugal
TRICOLOR	Car Carrier	2002	North Sea
CP VALOR	Container	2003	Azores
OCEAN VICTORY	Bulk Carrier	2006	Japan
ROKIA DELMAS	Container	2006	France
CALIFORNIA	Bulk Carrier	2006	Malaysia
SEA DIAMOND	Passenger	2007	Greece
FEDRA	Bulk Carrier	2008	Gibraltar
COSTA CONCORDIA	Passenger	2011	Italy
BARELI	Container	2012	China

[1] http://www.lloyds.com/the-market/tools-and-resources/lloyds-agency-department/salvage-arbitration-branch/scopic

2.2 Nick Haslam

2.2.1 After a career spanning 21 years at sea, he joined LOC as a marine consultant and has recently been appointed to the Group Board as Director Shipping Services.

He specialises in major marine casualty investigations including groundings, strandings, sinkings, total losses, oil removal, cargo recovery and collisions.

He is an approved Special Casualty Representative (SCR) and has been involved in a number of high profile salvage and wreck removal operations and has acted as Special Casualty Representative (SCR) on various salvage operations, including;

“SERGO ZAKARIADZE” (Puerto Rico),
“WORLD DISCOVERER” (Solomon Islands),
"BONGO DANIELSEN" (Cape Verde Islands),
“GAZELLE COAST” (Papua New Guinea),
“SHAUADAR” (Cuba),
“WILLY” (United Kingdom),
“JODY F MILLENNIUM” (New Zealand),
“CLIPPER CHEYENNE” (Ireland),
“GAZ POEM” (China),
“JAMBO” (United Kingdom),
“FU KUO HSIN 07” (Japan),
“CRISTOFORO COLOMBO” (Sakhalin Island),
“MSC AL AMINE” (Tunisia),
“MAERSK ENSENADA” (Cuba),
“OCEAN VICTORY” (Japan)
“ARCADIA PROGRESS” (India)
“J TONG” (Taiwan)
“THOR ACE” (Taiwan)
“SHEN NENG 1” (Australia)
“HAI SOON 5” (Papua New Guinea)
“NOBLE HAWK” (Indonesia)
“BUNGA ALPINIA” (Malaysia)
“RIO GOLD” (Myanmar)

He has had considerable experience with the following wreck removal operations;

“SAFMARINE AGULHAS” (South Africa),
“CP VALOR” (Azores),
“VICUNA” (Brasil),
“NEDLLOYD RECIFE” (Brasil),
“CORAL BULKER” (Portugal),
“CO-OP VENTURE” (Japan),

"TRICOLOR" (UK),
"JAMBO" (UK),
"VI HAN 05" (Japan),
"OCEAN VICTORY" (Japan)
"CALIFORNIA" (Malaysia)
"ASL PRONTO" (India)
"KC-19" (Sri Lanka)
"WEST ATLAS" (Australia)
"RENA" (New Zealand)
"TYCOON" (Christmas Island)

In addition, he has had involvement with other, smaller scale salvage or wreck removal operations in Europe and the sub-Continent. He has provided specific specialist salvage advice to underwriters on a number of salvage operations including the refloating of "MARIELLE BOLTEN" (Dominican Republic), "PACIFIC CHALLENGER" (Papua New Guinea), "SEMINOLE PRINCESS" (Indonesia) and "YUSHO SPICA" (Indonesia). In addition, he has provided assistance to the Irish Maritime Safety Authorities in the recovery of a sunken fishing vessel, has assisted SOSREP on a specialist cargo matter in the UK and also provided advice to Maritime Safety New Zealand (MNZ).

He has provided expert advice on offshore supply vessel operations, towage, wreck removal, salvage disputes and other commercial matters. He has provided expert evidence at arbitration in the UK and Chile and expert evidence in High Court in Malaysia and Singapore. In addition, he has acted as Technical Co-Mediator at mediation in the United States.

2.3 Assessing Wreck Removal

2.3.1 LOC is often appointed at the outset of a salvage service which, if unsuccessful may lead into a wreck removal. Wreck removals are generally undertaken once the regulatory authority issues a wreck removal notice, it is unlikely that an insurer will volunteer to remove a wreck without a regulatory requirement. LOC will determine whether there is a requirement for the wreck to be removed at all, this decision is made by undertaking a risk assessment of the wreck and how those risk elements may be impacted by the presence of the wreck.

In considering whether a wreck should be removed the following may be considered:

1. Does the wreck pose a risk to navigation?

2. Does the wreck and/or contents pose a risk to the marine environment?

3. Is the wreck located in a protected area (such as UNESCO World Heritage Centre) and as such, does it require to be moved.

4. Current status of the wreck and removal feasibility.

5. What can practically be achieved?

6. What potential removal methodologies exist?

7. Site conditions and how these may affect the removal operation; location, water-depth, weather, sea/swell etc.

8. Cultural significance (though it should be noted that this is not so significant in many jurisdictions).

9. Political sensitivities and public pressure.

10. Contract preference and cost estimates.

2.3.2 Once a vessel becomes a wreck, any salvage services (if there has been any) are generally terminated and an Invitation to Tender (ITT) prepared and sent to selected competent contractors. It is normal that during the interim period, between salvage and commencement of wreck removal a caretaker contract is established to meet the specific requirements of any relevant authority intervention. The contractors prepare their bids and these are sent to be assessed by the Club's appointed experts.

The selection is made on the basis of the contractors meeting the requirements of the ITT. The requirements of the ITT are specific to the wreck removal project in question and will take into account the requirements of the relevant responsible authority, specifics on the wreck and/or cargo itself, the environmental conditions at site, impact on the marine environment, risk to navigation, methodology, form of contract and cost.

2.3.3 It should be noted that there is no “fixed formula” in determining whether a wreck could or should be removed. No two removal operations are the same, each may pose separate risks and challenges and this should be considered at the outset. Whilst it is accepted that there are tried and tested salvage techniques which have been developed, refined and used for many years, the salvage industry is very innovative. In recent years we have seen the salvage industry employing and refining offshore (oil exploration) technology within some salvage services. The days of “too deep”, “too distant” and “too difficult” are long gone, it is now (in theory at least) possible to undertake recovery from extraordinary depths employing very innovative techniques. Wreck removal is a dynamic operation and subject to change at short notice, due to weather events (as an example, fortuitously the salvage industry is also dynamic in its approach to these operations and is also capable of making quick decisions in changes to methodology.

2.3.4 New Zealand is unique in that the cultural significance of the RENA grounding site is principal in any decision making process. It is unlikely that any other jurisdiction would place as much emphasis on cultural issues as New Zealand.

2.3.5 I have been asked to identify 10 casualties that are similar to RENA, in that they involve container vessels aground on a reef area, a similar distance offshore, in similar water depths with similar environmental conditions. Realistically this is an impractical proposition; I am unaware of any wrecks that have a similar set of circumstances as the RENA.

2.3.6 The RENA poses a number of challenges in respect to a full wreck removal operation. Initially the vessel was intact grounding on a reef in a remote location. As the salvage operation developed it was clear that the local environmental conditions were not conducive to simple salvage and later wreck removal methodologies. It has been observed that the existing wreck removal operation has been suffering an average weather downtime of around 57% (average) of the time. As the vessel became a wreck and deteriorated over time due to partial wreck removal and various weather events, the stern section slid down the rock reef system and is now lying (at its deepest) in 56 metres of water). The bow section has broken down effectively into 7 sections with some remaining on the reef but the remainder has been washed off the reef and is now lying in deeper water. The area between the two sections is littered with typical wreck and cargo debris that can be expected from the break-up of a container vessel.

This poses a number of problems for basic small scale wreck removal operations in that the shallow water around the bow precludes the safe access of lifting equipment, the deeper water around the stern precludes safe access by air divers. The area between the two wreck sections which contains the majority of the debris field cannot be easily grabbed clear due to the potential for damage to the reef infrastructure so is very dependent upon diver controlled small scale grabbing or direct diver removal.

2.3.7 It is also worth considering that there are many similarities within the 10 case studies considered to the RENA. A number of the wrecks considered were exposed to destructive forces from the environment, weather, sea and swell. Such conditions caused major changes to the structure of the wrecks in question, similar to the RENA case. These structural changes necessitated quite radical changes to the initial wreck removal proposals. Salvage and wreck removal is a very dynamic industry and is subject to changes in the wreck condition and the removal solution, fortunately the salvage contractors are also dynamic and are able to change their methodology at short notice as has been evidenced on the RENA remediation work.

3. RENA

3.1 How Much of RENA Remains?

3.1.1 AS LOC has not attended throughout the wreck removal operations we have relied upon third party contemporaneous evidence of materials removed from site to date. To allow us to assess the quantity of steel (wreck) that has been removed to date we have relied upon the TMC report "RENA – Full Wreck Removal Feasibility Appraisal" issued by TMC on 18 June 2014 and other documents submitted during the owner's RMA Consent application.

TMC has attended at site on behalf of owners and their P&I Club throughout the wreck reduction process and have been ideally placed to monitor the total amount of material recovered from the wreck site, including wreckage, cargo and containers (debris).

However, our opinions are based on the information available from the above referenced documents and not through our own attendances on site. Consequently, if there are any inaccuracies in these reports, they may be reflected in this report.

3.1.2 At page 30 of 107 of the TMC report a table is provided which shows that the lightweight of the RENA was 14,500.78 tonnes. This weight has been derived at from the docking plan and slightly exceeds the documented lightweight of 14,465 tonnes. However, for the purpose of this exercise the calculated figure of 14,500.78 will be used.

The table also shows the weight of the steel recovered ashore and confirmed by weighbridge calculations. The tonnages of the two main sections remaining on the seabed, the forward and stern sections has been undertaken by TMC and appears to provide a thorough and accurate analysis of the steel tonnages remaining.

The TMC report advises that the table summarises the weight of steel removed from the wreck as follows:

"4.5.3 The weight of the seven forward (bow) pieces remaining on the Reef was calculated by RSF and is tabulated in Section 4.2 above. The weight of the 'intact' aft section lying on the slope of the reef and the broken ship structure in the debris field cannot be calculated with accuracy. Nevertheless the weight of the aft section has been estimated using the spreadsheet of weight per length and dividing up the 'intact' structure visible in the 2014 ADUS survey (see Section 6.1 and Table 11). The spreadsheet was also used to determine the weight of the middle section between frame 170 and 190 that became part of the debris field.

4.5.4 The weight of the ship structure removed up until the end of April 2014 has been accurately recorded on a weigh bridge before it was transported from the Port of Tauranga to the scrap yard. This includes the hatch covers originally recovered during the salvage operation in 2012, the bow reduction steel, the accommodation top section, the port side piece (in way of No.4 Hold, in the aft section) and some ship pieces recovered from the debris field. All the above weights can be reconciled to determine the approximate amount of steel structure remaining in the debris field. The weight of ship structure in the debris field is thus estimated from the weight between frame 170 and 190 and any weight that cannot be accounted for in the forward and aft section weight estimates less the steel already removed. Table 6 summarises and co-relates the weights of the various hull sections.

4.5.5 The 'Totals' line in Table 6 above show that the ship total lightweight can be reconciled with the remaining wreck sections, the recovered steel and the structural steel in the debris field. The estimated weight of the seven bow pieces and the 'intact' aft section sum to 9146 tonnes. These estimated weights and the weighed weights of the steel recovered can be subtracted from the lightweight to arrive at the estimated weight of broken ship structure in the debris field. The debris field comprises the unaccounted for bow weight, the broken up Hold No.3 amidships, the unaccounted for stern weight and the missing hatch weights, less the ship *debris recovered, all summing to a total of about 2200 tonnes of ship structural steel in the debris field.”* [2]

3.1.3 The report below is referenced “Table 6 – Summary of Steel Weight All Sections” in the TMC report and is contained at page 30 of 107 of the report.

	Section	Totals	Wreck	Hatches	Recovered	Debris	Reference
Forward section	Lt. wt. fr.190 to fwd.	3207.13					Spreadsheet
	Hatch covers 1 to 5	-269.5		269.5			Drawing
	Hull fr.190 to fwd	2937.63					
	Bow reduction	-1263.09			-1263.09		Weigh bridge
	Bow remaining	1674.54					
	Bow pieces RSF estimate	1419	1419				RSF
	Unaccounted bow weight	255.54				255.54	
Hold No.3	Hull fr.170 to 190	940.13				940.13	Spreadsheet
Aft section	Lt. wt fr.170 to aft	10353.52					Spreadsheet
	Accommodation removed	-311.39			-311.39		Weigh bridge
	Port side piece removed	-613.83			-613.83		Weigh bridge
	Hatch covers 6 to C	-520		520			Drawing
	Stern remaining	8908.30					
	Stern remaining ADUS/TMC estimate	7727	7727				See Section 6.1 below
	Unaccounted stern weight	1181.30				1181.3	
	Hatches total			789.5	-668.07	121.43	Drawing
	Debris recovered				-297.89	-297.89	Weigh bridge
	Totals	14500.78	9146		-3154.27	2200.51	

Figure 1: Table Extracted From TMC Report

As can be seen from the above table[3] the quantity of steel wreckage remaining on the seabed, as estimated by TMC, is estimated at 11,346.51 tonnes (1419 tonnes (Bow Pieces), 7727 tonnes (Stern Piece and 2200.51 tonnes (Hold 3 and unaccounted for steel contained within the debris field)) .

[2] TMC report “RENA – Full Wreck Removal Feasibility Appraisal” Paragraphs 4.5.3-4.5.5 at page 29-30 of 107

[3] TMC report “RENA – Full Wreck Removal Feasibility Appraisal” Table 6 at page 30 of 107

3.1.4 TMC advise within their report that the debris field (the area lying between the two wreck sections) covers an area of approximately 11,000m^2 and is approximately 90 metres wide x 150 metres long and is laying, predominantly, in water less than 30 metres deep.

3.1.5 Up until the end of April 2014, debris recovered from the wreck site comprised 467 tonnes of metallic cargo (containers, cargo and ingots), 298 tonnes of ship debris and 119 tonnes of non-metallic debris. A total of 884 tonnes. TMC estimate that approximately 4,125 tonnes of cargo debris remains within the debris field. This debris consists of aluminium ingots, tyres, metal coils, plyboard, scrap metal, packaged goods (of various description) and broken pieces of ship and container structures.

3.1.6 It should be noted that the debris field discussed at paragraph 3.1.4 above is the principal debris field. The ADUS survey undertaken in April 2014 identified a further 80 targets lying outside of this area. Furthermore, debris does occasionally end up washed ashore on the various beaches surrounding the Bay of Plenty; it is therefore assumed that at least some of the debris is mobile to an extent.

3.2 <u>What are the Potential Impacts of Removing the Bow Section?</u>

3.2.1 The existing equipment being used by Resolve Salvage and Fire (RSF) is unable to directly access the remaining seven sections of steel wreckage that lay either on or adjacent to the Astrolabe Reef due to outreach limitations and draft limitations of the various craft. Therefore to enable the existing sheerleg to be used to remove at least some of the remaining bow sections would require the sections to be pre-rigged by the divers and pulled to deeper water before requiring re-rigging and lifting.

3.2.2 It has been highlighted in the BECA Report "APPLICATION FOR RESOURCE CONSENT (MV RENA) – Background and Consideration of Alternatives – Volume Three" that the wreck of RENA had previously been painted with an anti-foul paint said to contain Tributyltin (TBT).

3.2.3 Tributyltin (TBT) are organotin compounds that contain the $(C_4H_9)_3Sn$ moiety, such as tributyltin hydride or tributyltin oxide. For 40 years TBT was used as a biocide in anti-fouling paint, commonly known as bottom paint. Antifouling paint improves ship performance and durability, because its use prevents and slows the growth of organisms that attach to the hull. Although TBT anti-fouling paint is the most effective, TBT leaches from the ships hulls and has toxic effects on organisms at all points of the food chain, including mammals. It is particularly dangerous because it impacts development, which has led to collapse of whole populations of organisms.

Currently, TBT compounds are banned and are included in the Rotterdam Convention and have been banned by the International Convention on the Control of Harmful Anti-fouling Systems on Ships of the International Maritime Organization. Even though TBT is banned, it still presents a danger to our environment. Because TBT anti-fouling paint is still the most effective and cost efficient, it is being used in countries with poor regulation enforcement. This is particularly an issue in the Caribbean. Furthermore, TBT has a long half-life and remains in the ecosystem as a toxin for up to 30 years. This means that even if TBT use was completely eliminated, without a clean-up effort, it would continue to have toxic effects on the environment.[4]

3.2.4 Any operation to remove the remains of the wreck of RENA will result in the loss and dispersion of some of the TBT anti-fouling system contained on the hull sections. However, by not removing the wreck will result in the TBT remaining within the environment for a long period of time, up to 30 years due to its extended half-life properties.

3.2.5 It is likely that any actions that results in the hull sections being dragged over the underlying Astrolabe Reef rock system will result in the greatest form of TBT dispersion by “smearing” the TBT over a larger area.

3.2.6 The above scenario assumes that the Bow wreck sections are removed using the existing equipment on site. To avoid the requirement to drag the sections, alternative lifting equipment could be sourced and utilising a greater outreach the sections could be lifted. However, a number of vessels that frequent the waters of New Zealand are likely to be coated with TBT anti-fouling (albeit with a seal coat similar to RENA) and the risk from this paint should not be

[4] http://en.wikipedia.org/wiki/Tributyltin

blow out of proportion. It is highly likely that the hull of Mikhail Lermontov was treated with TBT anti-fouling which grounded and sank in Marlborough Sound in 1986; I am unaware of any long-term environmental effects that this wreck may have posed.

3.3 What Hazardous Materials Remain within the Bow Section?

3.3.1 The BECA Report "*Application for Resource Consent (MV RENA) Background and Consideration of Alternatives*" advises that "*diver observations from site indicate that there are no containers remaining in a form that would be recognised as a complete container.*"[5]

Furthermore, the 18 "*empty*" containers that remained in the Bow Section (prior to the two sections becoming detached) have been destroyed and form part of the general debris in the vicinity of the bow section.

Key here is the fact that the 18 containers that remained in the Bow section were empty containers and contained NO cargo.

3.3.2 It is known that the containers remaining within the bow section were empty of cargo; no other cargo or material remained in the bow section. Therefore it is safe to state that no known hazardous material(s) remain in the bow section of the wreck.

3.3.3 The RENA hull was known to be coated in TBT anti-foul paint, see paragraph 3.2.2 above. As such there is a minimum risk of contamination from the TBT compound contained within the hull paint, however the long term effects of this product are not known by the author of this report.

3.4 What Contaminants May Exist in The Stern Section?

3.4.1 The various dive surveys undertaken and the recent ADUS survey (April 2014) clearly show that there are NO intact containers remaining within or outside of the two wreck sections. As such, the contents of these containers have been dispersed. An argument put forward by the owners for not removing the contents of the containers was safe access by the divers. To

[5] BECA Report "Application for Resource Consent (MV RENA) Background and Consideration of Alternatives" Paragraph 5.3 at page 7.

directly access the debris inside the holds would have involved removal of the port side of the stern section of the wreck, something that owners argue was not safe to undertake.

3.4.2 In summary of the 1,368 containers on board at the time of the incident, 1,039 have been landed ashore either whole or in part, the remaining 329 containers are unrecovered. Of the unrecovered containers, 34 are said to be dispersed remote to the wreck, 18 are said to be remaining in the fore section (though none are intact and are effectively scrap) and 277 remain within the stern section or dispersed within the debris field. Diver observations at site indicate that there are no containers remaining in a form that would be recognized as a complete container.

3.4.3 Subsequent to cyclone LUSI, the stern section rolled further to starboard and the forward end (of the stern section) slid further down the reef area). This has resulted in part of the debris contained within holds 5 and 6 becoming exposed, at least in part. It is known that there was a container with copper clove cargo within Hold 6, owners had argued that the contents were not visible to the divers and could not be safely accessed. However, subsequent to LUSI at least part of this cargo has been exposed. RSF have recovered this exposed cargo, however the volume recovered forms only a small part of the 21 tonnes said to have originated from the container. The majority of this cargo remains within the environment.

3.4.4 The original manifest showed that there were four containers with plastic beads (Polyethylene microspheres); whilst this cargo is not classed as a marine pollutant they may become an aesthetic pollutant. Of the four original containers, all four have been broken up and at least in part recovered, however a large volume of the contents of the containers remain within the environment. Owners maintain an active recovery programme for recovery of the beads from the shoreline.

3.4.5 It is known that the hull was treated with TBT, see paragraph 3.2.2 above. As such a known contaminant is known to exist on the hull sections. The BECA report advises that when assessing the alternatives (for wreck removal) it is necessary to separate out those effects that have already occurred, or are likely to occur, as a result of the grounding and break-up of the ship, from the effects of the alternatives being considered. The report further advises; "***Even the alternative of FWR will not return the Reef or the environment to a "pre-Rena" state and has the potential to cause additional significant adverse effects.***"[6]

Whilst it is accepted that FWR will not repair the physical damage sustained to the rock structure of the Reef or replace the displaced sands adjacent to the Reef (where the wreck has slid down), I believe it is a moot point to argue that the FWR "***has the potential to cause additional significant adverse effects.***" Whilst not having a scientific background, it is difficult to conceive that leaving a wreck which is coated in TBT in situ is more beneficial than removal of the source. Similarly, the copper clove, which is identified in the BECA report has having a potential adverse effect on the marine environment as it can enter the food chain with adverse effects to some organisms, surely cannot benefit the environment by remaining in situ. The effects of cyclone LUSI and the previous storm systems experienced are evidence enough that the wreck and cargo are mobile. Additional dispersion, not removal, can only increase the adverse effect these products are already having on this affected environment.

3.5 What Monitoring Systems Should Be Established?

3.5.1 Monitoring requirements of any wreck are at the discretion of the regulatory authority. The level of monitoring will depend upon what requires to be monitored, as the contaminants remaining or unaccounted for in respect to RENA are known this should not be a problem. The two possible hazardous materials that are known to exist in respect of the RENA are copper clove and TBT; I understand that the RENA owners, in cooperation with the environment department, are undertaking periodic sampling from the wreck site.

3.5.2 Whilst not common it is also not unheard of to require a monitoring programme to be established. An example of a monitoring programme prescribed by a regulatory authority is the requirement of the Portuguese

[6] BECA Report "Application for Resource Consent (MV RENA) Background and Consideration of Alternatives" Part 8, Chapter 7, page 17.

Authorities who required an inspection programme to be established for a 5-year period to observe the beach area (for contamination of debris) in respect of CP VALOR at Faial in the Azores.

3.5.3 In respect to RENA I am of the opinion that any monitoring programme should be established by the relevant environmental department and in cooperation with the Bay of Plenty regional Council.

3.5.4 Subsequent to cyclone LUSI it is known that at least one part of the Bow Section moved in the high seas and swell. This may have resulted in at least part of that section becoming shallower (though this has not been confirmed); if it is thought that this is a potential problem then it may be that a monitoring programme be prescribed for this area. However, it should be noted that even if the section is lifted closer to the surface, once the equipment is demobilised from New Zealand waters it is highly unlikely that any operation would be authorised by the owners to remobilise equipment and remove the section.

3.6 What Would The Cost Be For Removal Of RENA?

3.6.1 TMC have prepared a report on behalf of the owners of RENA entitled; “RENA – Full Wreck Removal Feasibility Appraisal” dated 18 June 2014. This report forms part of the RMA consent application. TMC have undertaken an in-depth analysis of the existing components of the wreck of the RENA, the report treats the residuals in three components, namely; Bow section, Debris Field and Stern Section.

3.6.2 The report considers various options of dealing with the wreck and concludes that the only viable option is a piecemeal removal. Their analysis results in concluding that the stern section would have to be divided into 29 separate sections for removal, the bow section in 7 sections and the debris field removed piecemeal. The report discounts alternatives that LOC consider are worth further investigation, however for the purposes of this report I have considered the options presented by TMC only.

3.6.3 **STERN SECTION**:

TMC propose sectioning the stern into 29 separate lifts. This will result in a timeline of around 513 days, allowing weather down-time of between 45%-60% results in a total time on site of between 933-1283 days (2.6-3.5 years). This method relies on a similar operation as that previously undertaken at site (albeit with a larger sheerleg of a 1500 tonnes capacity). TMC have indicated a day rate for the spread of around US$337,000/day; on the basis of 933-1283 days on site it is therefore estimated that costs to remove the stern section will amount to some US$314million to US$432million. This price does not include mobilisation/demobilisation costs which TMC estimate at US$6million to US$8million.

An alternative methodology (which relies on the existing smaller sheerleg) is quoted which requires 1882 days to 2588 days (inclusive of weather down time) at a day rate of US$293,300/day which equates to a cost (dependent upon weather downtime) of US$552million to US$759million.

3.6.4 **BOW SECTION**:

TMC advise that the total timescale for the removal of the seven bow pieces (including dragging to deeper water) will be 176 days. Allowing 57% downtime (which they advise has been experienced to date) this increases to a total exposure on site of 410 days. Based on the existing spread they advise the day rate to be US$193,000/day, this equates to an estimated total cost for removal of the bow section of US$79million.

3.6.5 **DEBRIS FIELD**:

TMC advise that based on the experience to date, approximately 50 tonnes of debris has been removed per day. On the basis that approximately 3,900 tonnes remain within the debris field then this could be recovered in 80 days, however a further 30 days is allowed for "sweeping" the area using the magnet. On the basis of 40% weather downtime (an assumed figure by TMC for a larger cargo barge) then the total time on site is increased to 184 days. TMC advise that the reduced spread for the debris removal will be around

US$160,000/day, the estimated cost for removal of the debris field is US$29.5million.

3.6.6 In total, TMC advise that the cost for removal of the three components that form the RENA wreck (Bow, Debris and Stern) is between (US$314million-US$432million)+US$79million+US$29.5million = **US$422,500,000 and US$540,500,000.** It should be noted that this is not the higher figure quoted in the TMC report, the alternative method costs even more! Given that TMC do not envisage any operations running concurrently (for some reason) then the total time on site for all three operations is 1283+410+184= 1877 days (5.14 years).

3.6.7 If we assume that TMC are correct in all their assumptions and calculations, then the figures quoted are not unrealistic. However, I urge caution here. I do not believe that the day rate quoted for the spread for removal of the Stern Section is realistic, I previously estimated a day rate of US375,000/day for an advanced offshore DP heave-compensated crane vessel, this does not really tally with what TMC are quoting for basic sheerleg spread with saturation diving etc. If the DP vessel were to be available (there is no guarantee that it will be) then even if it took a year to remove the whole wreck it would "*only*" cost US$136,875,000. A DP vessel, such as JASCON 25, is capable of undertaking quite substantial lifts in sea states of up to 3 metres, analysis of the weather data shows that such conditions are only exceeded on less than 3% of the time. Therefore such a spread would not be susceptible to the huge downtimes being quoted by TMC. Despite TMC advising that such vessels are never used in the salvage industry, this is incorrect; JASCON 25 was used in the wreck removal of the jack-up rig WEST ATLAS.

3.6.8 I would advise that even if such a DP vessel was readily available, there would be a long lead-time on engineering. If the wreck could be split into half the amount of lifts being quoted by TMC, say 22, this would still entail a long operation at site and as a consequence a large cost. Whilst I believe that TMC have grossly exaggerated the timescale and costs I still think this would be a very expensive operation and I am certain the insurance market would not stomach this after the time and money spent to date.

4. CASUALTIES REVIEWED

4.1 Summary Table

I have attached a table at Appendix A which summarises the 10 wrecks used for comparative purposes.

It should be noted that in the limited time available it has not been possible to research in depth in respect of similar sized vessels in similar locations as the RENA. It is reasonable to state that the cases assessed below are all unique in their own way and each posed separate problems requiring individual solutions.

Paragraph 4.11 reviews MSC AL AMINE, whilst this was not a wreck removal as the vessel was salvaged and returned back to owners it is worth considering due to the vessel type and its location.

4.2 CORAL BULKER

Figure 2: Parbuckle of forward section.

4.2.1 Impact of location, water depth, response equipment mobilisation and weather

CORAL BULKER ran aground on an exposed breakwater after dragging anchor on 25 December 2000. The vessel was carrying 610 tonnes of HFO at the time of grounding. The initial grounding breached a number of fuel oil and ballast tanks resulting in an oil pollution incident. The coastline in this area is exposed to the winter Atlantic swells and the ship was battered relentlessly by the winter seas and swells. The vessel was carrying a full cargo of sawdust, woodchip and sawn timber below deck and a full deck cargo of logs.

Initially a salvage contract was agreed with Smit Salvage who undertook the oil removal. During this period the vessel was declared a constructive total loss (CTL) and an ITT was prepared. Smit remained on site in a caretaker role during this period, continuing to strip hydrocarbons and other pollutants from the wreck. Titan were awarded the wreck removal and undertook an innovative wreck removal operation, discharging all cargo and cutting the wreck into two sections before rolling them onto the breakwater for disposal locally.

4.2.2 Extent of Government/other authority intervention

The Director General issued a wreck removal notice to the owners requiring a total removal of wreck, pollutants and cargo. Despite this intervention, through close cooperation with the local authorities there were no delays and the wreck removal was completed on time and within budget. Small sections of the outer shell plating remained on the rock breakwater as it was agreed with the Harbour Master that it was too dangerous to attempt to remove these, otherwise the wreck and cargo were removed to the satisfaction of the authorities.

4.2.3 What remained and why?

It was agreed with the Harbour Master (who acted on behalf of the regulatory authority) that with the bulk of the wreck removed some small sections of double bottom and shell plating could remain on the outer face of the rock reinforcement of the breakwater. It was thought that it was far too dangerous for the divers to attempt to remove these sections. The amount remaining was never quantified.

4.2.4 **Total Cost of Removal?**

The total cost of removal was $8million which did not include the LOF/SCOPIC costs and oil clean-up costs ashore.

4.3 TRICOLOR

Figure 3: Successful lift of second wreck section.

4.3.1 Impact of location, water depth, response equipment mobilisation and weather

The TRICOLOR collided with the KARIBA on 14 December 2002 in the vicinity of the Hinder No 1 buoy in the French EEZ of the English Channel. The TRICOLOR sank in 27 metres of water and came to rest on the sea bed, overturned sideways with the starboard side facing up. The TRICOLOR had sunk in a very busy part of the traffic separation scheme and represented a hazard to navigation given its exposed position. The TRICOLOR was carrying 2,871 cars.

An oil removal operation was initially undertaken by Smit Salvage under a modified BIMCO wreck contract. An ITT was run during this period and the contract awarded to a Smit-led consortium. A BIMCO WRECKSTAGE contract was signed on 11 April 2003; however, due to heavy weather and the winter season, the removal operations were suspended until Spring and not completed until October 2004, one year later than scheduled. The necessary response equipment was available locally and on site within one week. The ROW operations were completed later than expected.

4.3.2 Extent of Government/other authority intervention

Whilst there was a high level of intervention on the part of multiple governments and local authorities, through close and regular liaison with the various authorities, this did not result in additional cost.

4.3.3 What Remained and Why?

Post removal of the main sections of the wreck, the salvage contractors utilised the large Smit grab to remove any major pieces of wreck and/or cargo from the seabed. Contractually they were obligated to remove anything above $1m^2$ in size. Upon completion of the removal operation, the area was swept with both SONAR and a magnetometer to identify any major sections remaining; anything identified was investigated by divers and was removed. Small pieces of scrap were allowed to remain within the soft sandy seabed area, though the amount was never quantified.

4.3.4 Total Cost of Removal?

The total cost of the wreck removal and the LOF/SCOPIC costs amounted to $54.742million.

4.4 CP VALOR

Figure 4: Removal of DG Cargo by Helicopter.

4.4.1 Impact of location, wreck situation, response equipment mobilisation and weather

The CP VALOUR, a container vessel, grounded on 9 December 2005 in the Baia Da Riberia Das Cabras on the North West side of Faial in the Azores. The location of the casualty in the Azores, a world heritage site, meant that, at all stages, careful consideration had to be given to the environmental impact of the casualty and the wreck removal operation. The vessel grounded with a list approximately 16° to port. She was carrying 900 TEU containers.

The vessel stranded on a north-facing beach (the prevailing weather being from the north) such that it was impossible to work between September and April. Throughout the operation, the vessel was subjected to severe and incessant pounding from the sea. Approximately two weeks of working time in total was lost due to storms.

Response equipment was not available locally, and it took two to four weeks to mobilise equipment on site due to the remoteness of the casualty and the prevailing weather conditions. Once commenced, the operations were completed on schedule.

4.4.2 Extent of Government/other authority intervention

Whilst there was a low level of intervention on the part of the Portuguese government and local authorities, this resulted in significant additional cost. The authorities laid down strict requirements in relation to the ROW operation because of environmental concerns including:

- The beach was required to be cleaned daily at a total cost of approximately US$2 million;
- The Lloyd's Open Form contractors were required to remain on site for container monitoring and retrieval;
- The salvage contractors were required to re-attend on site for five years to ensure no debris remained; and

All hazardous cargo was required to be removed from the ship. The contractors responded to this stipulation by chartering a helicopter which was dismantled in central Africa, transported to the site (in the Azores) and then returned to central Africa. However, the helicopter only succeeded in removing two 40' containers and the contents of one 40' container.

4.4.3 What remained and why?

Upon discharge of all cargo from the wreck (with the exception of some crushed and damaged containers that remained in the cargo holds, the accommodation was removed and the hull structure cut down to lighten the wreck. Upon completion the wreck was towed free from the grounding reef area, the hull was badly damaged and it had previously been agreed to tow the wreck to a holding ground to assess the hull. Whilst being held at the holding area the hull sank in deep water.

Small sections of shell plating and double bottom remained at the grounding site. This was never removed but was not quantified. The regulatory authority required owners to establish a 5-year monitoring programme to ensure no debris washed up on the beach area.

4.4.4 **Total Cost of Removal?**

The total cost of the removal of the wreck and the LOF/SCOPIC costs amounted to $44.553million.

4.5 ROKIA DELMAS

Figure 5: Removal of hydrocarbons.

4.5.1 Impact of location, wreck situation, response equipment mobilisation and weather

The ROKIA DELMAS, a combined Ro/Ro and container vessel grounded on 24 October 2006 in shallow waters, one mile outside Ile De Re, La Rochelle. The vessel grounded with a list to port of 18°. Due to the spring tide during the grounding, the ship was extremely hard aground.

The vessel was laden with 8,614 metric tons of plywood and sawn timber; in addition there was a containerised cargo on the Ro/Ro deck.

The wreck was surrounded by oyster farms and exposed to the Bay of Biscay. Initially hydrocarbons were removed under a salvage contract, during this period an ITT was prepared and the wreck contract awarded to Smit Salvage. The wreck removal operations were delayed due to the exposed position of the wreck in the Bay of Biscay and the weather had an adverse impact on the wreck removal operation undertaken by floating cranes, the operations being extended by some 30 days. The response equipment was available locally and mobilised in less than one week.

4.5.2 Extent of Government/other authority intervention

There was a high level of intervention on the part of the French government and local authorities which resulted in significant additional cost. The French authorities required pollutants and deck cargo to be removed before SCOPIC could be terminated. The local authorities required asbestos to be removed and disposed of in accordance with French regulations at a cost of €12.2 million. The site was returned to its pre-grounding condition and the wreck and cargo were removed in their entirety.

4.5.3 What remained and why?

Upon completion of the removal of the five principal sections of the wreck, an inspection dive took place on 17 December 2007. Some residual debris was reported, which was then removed on 18 December by the worksite operator.

When all the sections of the wreck of the Rokia Delmas had been removed from the sea, the site where the vessel grounded had been returned to its original state and the risks of harm to the environment had been eliminated, the formal notice given to the shipowner was lifted. On 19 December 2007, this final administrative act definitively closed the “at sea” phase of removal operations, which then continued on land.

The requirements of the French intervention notice was to return the grounding site to its original conditions, nothing remained on location upon completion of the wreck removal.

4.5.4 Total Cost of Removal?

The total combined cost of the removal of the wreck and the LOF/SCOPIC costs amounted to $73.284million.

4.6 MSC NAPOLI

Figure 6: MSC NAPOLI beached in Lyme Bay.

4.6.1 **Impact of location, wreck situation, response equipment mobilisation and weather**

The MSC NAPOLI, loaded with 2,318 containers, encountered difficulties whilst transiting the English Channel and with the support of the SOSREP was beached on 18 January 2007 in Lyme Bay to avoid her sinking in the English Channel.

The vessel lay aground and semi-submerged vulnerable to the effects of the sea. On 20 January, she developed a 40° list leading to the loss of over 100 containers during deteriorating weather conditions. Some of the lost containers sank but many washed up on the beach. The local police did not secure the relevant beaches for several days and as a consequence there was substantial looting from the accessible containers. The removal of the containers from the shore/seabed was not completed until the end of September 2008.

The original ROW response envisaged the removal of containers and refloating of the vessel complete. However, removal of the containers remaining on the vessel presented the salvors with numerous practical challenges (pronounced list, distortion of containers and cell guides and storage capacity ashore) and by the time it was viable to attempt a refloating and tow, it was determined that the hull had suffered too much damage for this to be a realistic option. At this point the method moved to one of removing the ship in parts. The forward section was separated, refloated and towed to a shipyard in Belfast for scrapping. This phase was completed in March 2008. The weight of the engine necessitated a different approach being adopted for the aft section. The initial plan involved dismantling this section on site. However, the cutting equipment deployed by the salvors - used successfully on the ROKIA DELMAS casualty - proved unable to deal with the larger steel sections of this vessel. Accordingly, in close consultation with the SCR, a new plan was developed. This entailed passing a number of hoisting wires under the hull and attaching them to winches fixed to two large barges. The aft section was successfully lifted from the seabed in July 2009.

This ROW operation was completed 20 months after the date initially envisaged. This was mostly attributable to complications arising from the exposed location of the vessel but the enforced change of methodology for removal of the aft section was also a material factor.

The necessary response equipment was available within northern Europe but took several weeks to mobilise on site.

4.6.2 **Extent of Government/other authority intervention**

After the vessel had grounded, a high level of intervention on the part of the UK government, local authorities and environmental NGOs was encountered. The need to satisfy a wide variety of parties with differing interests and concerns about each proposed response before formal approval was forthcoming was achieved without material delay to the ROW operation but at substantial cost.

The SOSREP exercised his powers of intervention by permitting the vessel to be grounded and securing the co-operation of the port of Portland for processing the recovered containers. His role in the wreck removal operation was less well defined because by that time the necessity for urgent decision making was less compelling, but even so his pragmatic and balanced approach throughout was notable.

The delay in the local police securing access to the beach increased the level of pilferage of cargo and increased the level of clean-up required.

This case demonstrated the benefits of the affected state having the ability in the casualty stage of the operation to make well-judged decisions free of political considerations. This was further emphasised during the ROW operation by when the SOSREP's ability to intervene was much reduced.

4.6.3 **What remained and why?**

I have been unable to find out what, if anything was allowed to remain of the wreck. I understand that it was a requirement of the contract to remove everything above 1m^2 of the wreck and/or cargo. As this was closely monitored by UK SOSREP it is believed that contractual obligations were achieved.

4.6.4 **Total Cost of Removal?**

The total combined costs of wreck removal and LOF/SCOPIC costs amounted to $134.301million.

4.7 NEW FLAME

Figure 7: NEW FLAME prior to wreck removal operation.

4.7.1 Impact of location, wreck situation, response equipment mobilisation and weather

The NEW FLAME, a bulk carrier, was in collision with the "Torm Gertrude" on 12 August 2007, off Gibraltar. The vessel was beached off Europa Point with her foreship on the ground upright and semi-submerged in shallow water. The grounding location was half a mile south of Europa Point on a submerged peak of 18 metres depth, surrounded by deeper waters of 40 to 60 metres. Strong local currents existed around the submerged peak, particularly at spring tides. Approximately 16 days' work was lost due to very strong tidal currents in the order of six to seven knots. The location was also open to seas and swells close to busy sea lanes. On 10 February 2008, the aft section fully sank following a storm and the whole vessel was then submerged and consequently all work/rigging was dependent upon divers. The estimated impact on costs due to weather delays was about US$30 million and the operations were extended by about 147 days.

The vessel was carrying 42,200 metric tons of scrap steel.

The necessary response equipment was not generally available locally and the equipment mobilised from northern Europe to Gibraltar took two to four weeks to arrive on site. The operations were completed later than expected.

4.7.2 Extent of Government/other authority intervention

There was a high level of intervention on the part of both the Gibraltar authorities and the Spanish government and local authorities which resulted in significant additional cost for reasons including:

- The authorities did not allow salvors engaged under SCOPIC to demobilise for nearly two months until a new contractor was on site. It is estimated this increased costs by approximately $9 million;
- The requirement that scrap be disposed of in accordance with local environmental regulations following a local shipyard terminating contractual arrangements. The member incurred costs associated with chartering a barge to transport the stern section of the wreck for scrapping in Belgium;
- Customs delays at the Gibraltar/Spanish border; and
- Authorities required the salvors to (unsuccessfully) attempt to cut off the engine room section of the wreck.

4.7.3 What remained and why?

Sections of the crushed double bottoms and the outer shell plating were allowed to remain on location after being folded and a minimum clearance of 17.7 metres (chart datum). The amount remaining totalled around one third of the lightweight of the wreck. As these posed no threat to navigation and were under and around a rock pinnacle/cliff which dropped into much deeper water they were deemed to pose no threat.

4.7.4 Total Cost of Removal?

The total cost of wreck removal and LOF/SCOPIC amounted to $177.372million.

4.8 SEA DIAMOND

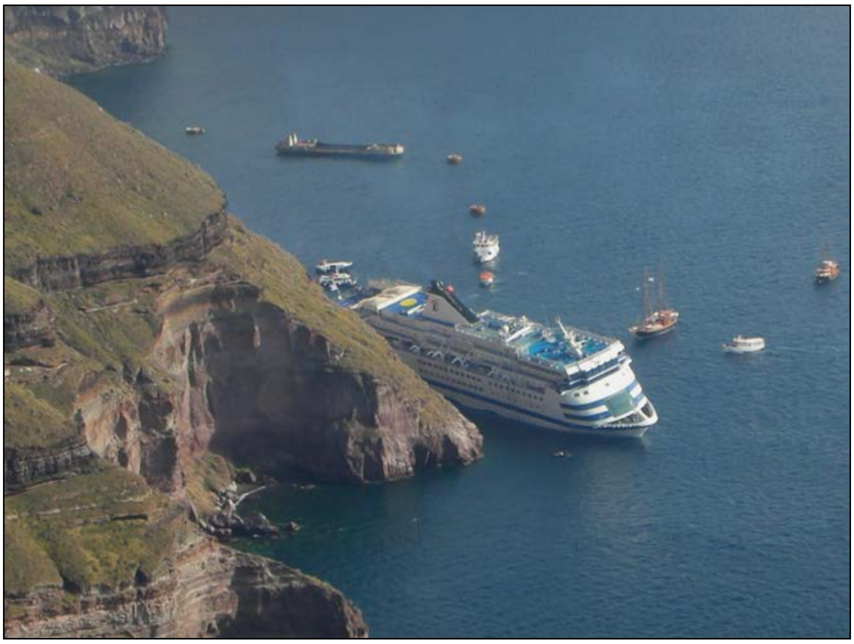

Figure 8: SEA DIAMOND prior to beaching/capsizing.

4.8.1 Impact of location, wreck situation, response equipment mobilisation and weather

The SEA DIAMOND, a passenger/cruise ship, grounded on an unchartered submerged extension of a reef off the Santorini Caldera, Greece. The vessel sank in 140 metres of water, lying upright on her keel, inclined by approximately 20°. The wreck site was exposed to swell and the effect of wash from passing vessels. A bunker removal operation was carried out by an ROV but was delayed by approximately seven days due to heavy swell making the launching and retrieval of the ROV impossible on certain days.

The vessel was carrying 1,155 passengers and 391 crew.

The necessary bunker removal equipment was not available locally, except for small tenders, launches and oil boom maintenance boats. The OSV and ROV were mobilised from Malta and Scotland respectively. Although the vessel sank in April 2007, the bunker removal contract was not signed until May 2009.

4.8.2 **Extent of Government/other authority intervention**

There was a high level of intervention on the part of the Greek government and local authorities which resulted in modest additional cost for reasons including:

- Delay in approving the operation;
- Lack of guidance in relation to their expectations and understanding of what could realistically be achieved; and
- Delay in approving the completion of the operation to remove all reachable and pumpable oil.

The wreck continues to emit reducing quantities of oil which is contained by a boom and then removed. The local authorities have requested the wreck be removed (although a wreck removal order has not been issued), despite it lying in 140 metres of water and despite the cost and risk of uncontrolled pollution ROW would involve. Proceedings have now been issued for a contribution to the ROW costs but it is doubted the Greek government or local authorities would proceed with a ROW operation.

4.8.3 **What remained and why?**

The wreck, in its entirety remains sunk within the Santorini Caldera. Whilst this is under discussion within the Greek courts it is thought that it will not be a requirement to remove the wreck.

The wreck has had the majority of bunkers removed or recovered from the surface and lays at a depth which is not a risk to navigation. The slopes of the caldera are very steep and it is thought that any wreck removal will prove costly, be protracted and would be inherently risky.

4.8.4 **Total Cost of Removal?**

The total cost to date stands at $57.983 million, however the wreck remains sunk within the Santorini caldera.

4.9 FEDRA

Figure 9: FEDRA at the foot of Europa Point.

4.9.1 Impact of location, wreck situation, response equipment mobilisation and weather

The FEDRA, a gearless bulk carrier, dragged her anchor in deteriorating weather conditions and despite the attendance of tugs, grounded at the foot of Europa Point on 10 October 2008. The vessel grounded in an upright position.

The vessel was in ballast.

The vessel grounded at Europa Point in a very exposed position with adverse weather conditions and strong tides. Difficult access from the sea and steep cliffs ashore, weather and sea state conditions and the proximity of a major sewer overfall resulted in the operations being extended by some 50 days. Some of the required response equipment was available locally and took less than one week to mobilise. The contractors Titan were already available on site dealing with a previous casualty and dealt with bunker removal and refloating of the bow section and removal of the accommodation block. The removal of the stern section went to tender. Donjon Marine was awarded the contract on a fixed lump sum basis. The overall operation was completed later than expected.

4.9.2 **Extent of Government/other authority intervention**

There was a high level of intervention on the part of the Spanish government and the Gibraltar authorities which resulted in significant additional cost, estimated at 50% of the total cost. This was as a result of the Spanish government preventing delivery of the accommodation and forward section to Algeciras for disposal. The Spanish government frequently closed the border and the Gibraltar authorities initially fettered the member's discretion in relation to the selection of a salvage contractor. The political situation in Gibraltar made operating there difficult.

4.9.3 **What remained and why?**

It is not known what, if any, of the wreck remained on site. However, it should be noted that this area had previously been used as a "disposal" site so it is likely that it would have been very difficult to differentiate between FEDRA and previously existing scrap.

4.9.4 **Total Cost of Removal?**

The total combined cost of wreck removal and the LOF/SCOPIC costs is $60.7million.

4.10 MSC CHITRA

Figure 10: MSC CHITRA Prior to wreck removal.

4.10.1 Impact of location, wreck situation, response equipment mobilisation and weather

The MSC CHITRA, a container vessel, collided with the "Khalijia 3" whilst leaving the port of Mumbai on 7 August 2010. Following the collision, MSC CHITRA proceeded a short distance before grounding on a shallow clay seabed and lay aground with a list, semi submerged and was considered a navigational hazard.

The vessel was carrying 1,219 containers.

The wreck removal operation was hampered by adverse monsoon weather conditions and strong currents, but the effect of this in terms of time and cost has not been quantified. The necessary response equipment was not available locally and this took two to four weeks to mobilise on site. The delays in mobilisation were caused by sourcing response vessels and equipment and the distance it was required to travel to site and obtaining permits and permissions from the customs authorities. The operations once commenced were completed on schedule.

4.10.2 **Extent of Government/other authority intervention**

A removal notice was issued by the Director General of the Maritime Authority who required complete removal of the wreck and cargo on the basis of it posing a risk to navigation.

There was a high level of intervention on the part of the Indian government and local authorities which resulted in modest additional cost, largely arising out of customs issues.

4.10.3 **What remained and why?**

MSC CHITRA was eventually refloated and was towed out sea and dumped in deep water. Therefore nothing was left behind at the original grounding site.

4.10.4 **Total Cost of Removal?**

The total combined cost of the wreck removal and the LOF/SCOPIC costs stands at $102.474million.

4.11 MSC AL AMINE

Figure 11: MSC AL AMINE Aground at Qurbus.

4.11.1 Impact of location, wreck situation, response equipment mobilisation and weather

On 15 February 2005, the Moroccan-owned, 13-year-old, 137 m long container ship MSC Al Amine suffered mechanical failure, dragged anchor and grounded in the Gulf of Tunis near the Qurbus in the Gulf of Tunis, spilling 100 to 150 tonnes of heavy fuel oil.

The vessel was carrying very few containers within the holds as she was anchored and awaiting cargo in the Gulf of Tunis. The initial grounding caused the engine room to flood and caused damage to the double bottom fuel oil tanks which resulted in the oil entering the cargo holds through cracks in the tank top. Oil was removed from the damaged tanks prior to the refloating operation.

Despite being only 12 miles from the Port of Tunis the location was very remote and access to the ship difficult. The Naval Authorities assisted salvors in mobilising their equipment to the ship by allowing them to use a military helicopter to lift equipment onboard.

After successfully refloating the vessel, salvors towed the vessel to Bizerte where it was redelivered to owners in the dry dock at the port.

4.11.2 **Extent of Government/other authority intervention**

The Tunisian Naval Authorities issued the owners with a removal notice and were insistent that bunkers were removed from the exposed and damaged double bottom tanks. The authorities were helpful and cooperative throughout providing salvors with assistance were possible. The intervention did not cause any delay or additional expenditure.

4.11.3 **What remained and why?**

The vessel was successfully refloated and redelivered back to the owners. As such nothing remained at the original grounding site.

4.11.4 **Total Cost of Removal?**

As this was not a wreck removal and the vessel was redelivered back to owners under a LOF/SCOPIC contract, the salvage award was not published (the changes to LOF2011 allows the publication of the awards but at the time of this operation this information was deemed confidential).

5. SUMMARY

5.1 Best Practice

5.1.1 There has been a change in perception of wreck removal over the last 1-2 decades. Prior to this, it was not uncommon to remove hydrocarbons and any other potential pollutants, sanitise the wreck (remove loose and potentially harmful fixtures and fittings) and then apply to the relevant authority to leave the wreck in situ. Subject to there being no immediate pollution threat and the wreck causing any immediate navigation risk then it was not uncommon to obtain this permission.

However, there has been a trend in recent years which has resulted in a hardening of attitudes by the relevant authorities. This change in attitude may be a result of public pressure and opinion which has resulted from rapid dissemination of news stories. The global change towards better environmental awareness has given the public a voice which elected governments are obligated, by public pressure, to respond to. Despite this change in attitude we have experience in several recent cases where the authorities have been persuaded to secede to this trend. Some of these cases have resulted in partial cut down but some have resulted in pollutant removal and then permission being sought to leave the wreck intact.

5.1.2 It is not possible to have a single rule which will be applicable to each wreck in question. The risks posed by the wreck should be considered in depth before any intervention notice is issued. Navigation risks, environmental risks and long term risks should be determined; ultimately the reasonableness of any intervention must be questioned. Just because a wreck can technically be removed is not always justification that it should be. There is plenty of precedent of wrecks being allowed to remain in situ.

5.1.3 LOC is aware of one jurisdiction that applies the rule that if it is technically possible to remove the wreck then it should be removed. As some jurisdictions have hardened their stances so has the insurance industry, we are aware that the P&I Clubs and their reinsurers are closely monitoring developments in the industry and they are also are considering taking a hardened stance on unreasonable intervention. LOC has been involved in two papers recently commissioned by the P&I Clubs and Lloyd's of London (The "IG Large Casualty Working Group review Of casualties Involving Salvage/SCOPIC and Wreck removal 2002-2012" undertaken by the IG and "The Challenges And Implications Of removing Shipwrecks In The 21st Century" undertaken by Lloyd's.) It was evident throughout both of these processes that the insurance industry in general is concerned at the spiralling cost of wreck removal.

5.1.4 I am comfortable in stating that as a general rule, P&I insurers will undertake initial response in respect to pollutant removal and remediation work in respect to navigation risks and will then rely on specific removal notices to undertake the actual wreck removal. I am unaware of any P&I Club voluntarily removing a wreck, unless they perceive there being a long term liability due to the potential for "risk to navigation" resulting from changes to the wreck.

5.2 Key Factors

5.2.1 When assessing whether a wreck should be removed the obvious initial considerations should be the risk posed to the environment and the risk posed to navigation. It is obvious in both these assessments that if a wreck is posing or likely to pose such a threat then remedial action will be required. It is debatable on a case by case basis what form the remedial action should take.

5.2.2 Despite the obvious initial considerations these are not the only ones to be consider. One of the case studies involved a vessel grounding in an area classed by UNESCO as a World heritage site, as such despite the wreck not posing any risk to navigation or environment (once the pollutants and cargo had been removed) there was a requirement to remove the wreck.

5.2.3 New Zealand is quite unique in that the cultural significance of a site is a particular issue. I am not aware of anywhere else where such emphasis would be applied. Despite this it is a significant consideration in certain cases. As I am unaware whether this has ever been tested in any legal case outside of New Zealand it is difficult to determine how the insurance interest would respond to intervention resulting from such considerations.

5.2.4 In addition, New Zealand does not have the ability to issue formal wreck removal notices, this process has been replaced by the Resource Management Act. This Act does not ideally suit wreck removal, as the owner has to apply to dump a wreck after the event. That is, the application is made post event, the wreck is already there prior to the application being made.

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APPENDIX "A"

SUMMARY TABLE OF CASE STUDIES